

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

ETM7146 - SWITCHING AND NETWORKING TECHNIQUES AND SYSTEMS

(All section / Groups)

6 MARCH 2019
2:00 P.M- 5:00 P.M.
(3 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 7 pages including cover page with 4 Questions only.
2. Attempt all **FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the answer Booklet provided.

Question 1

- (a) Provide FOUR (4) advantages of packet switching. [4 marks]
- (b) As an engineer, you are asked to design a telephone system trunking for a new building that is currently being developed. The building is expected to hold 150 companies. Each company is expected to have an average of 70 outgoing calls and 50 incoming calls. Each call takes an average of 2 minutes. Find:
- (i) The outgoing and incoming traffics for each company. [3 marks]
 - (ii) The outgoing and incoming traffics for the whole building. [3 marks]
 - (iii) Total occupancy of line for the whole building. [2 marks]
 - (iv) The outgoing, incoming and total traffic lost if the outgoing calls have 3 calls lost and the incoming calls have 1 call lost for each company. [3 marks]
 - (v) The grade of service for each incoming and outgoing trunks. [2 marks]
- (c) Due to fast growing business activities on Penang Island, the existing switch at the local exchange has to be upgraded. If the offered traffic is 13E, determine the minimum number of trunks lines the switch need in order to comply with grade of service (GoS) of 0.001? (Refer to Erlang B traffic table in appendix) [2 marks]
- (d) Design a three-stage space division switch of 10 inlets and 10 outlets which consists of 3 types of switch that use 5×2 in stage one, 2×2 in stage two and 2×5 in stage three. [6 marks]

Continued...

Question 2

- (a) Describe the THREE (3) modes of operation for a 3-stage network link system. [3 marks]
- (b) If a single-stage switching network with 25 incoming and outgoing trunks respectively, find:
- (i) What is the maximum number of simultaneous calls? [1 mark]
 - (ii) What does it mean by full-availability. Discuss the term with respect to the given switching network. [2 marks]
 - (iii) Calculate the percentage of crosspoints usage at high load. Comment on your result. [2 marks]
 - (iv) Say that by using two-group gradings, the availability of the switching network is 15. Draw the full diagram and the grading diagram.
[Given: $k = s + c$, $N = 2s + c$, where k = availability, s = number of singles, c = number of commons] [3 marks]
- (c) With respect to common channel signaling (CCS) and inchannel signaling, answer the following questions:
- (i) Why the control signal delay is high when an inband signaling technique is used? [3 marks]
 - (ii) Compare between out of band inchannel signaling with CCS. [4 marks]
 - (iii) Comment on when is best to implement associated mode and when to deploy disassociated mode. [4 marks]
 - (iv) Discuss four disadvantages of CCS. [3 marks]

Continued...

Question 3

- (a) Describe about communication protocol, protocol stack and signaling. [9 marks]
- (b) A pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. Answer the following:
- (i) Find the average frame transmission time. [2 marks]
 - (ii) Find the vulnerable time. [1 marks]
 - (iii) What is the requirement to make this frame collision-free? [2 marks]
 - (iv) Draw a related diagram all of the above to support your answer. [3 marks]
- (c) A network using carrier sense multiple access/ collision detection (CSMA/CD) has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal) is 25.6 μ s,
- (i) find the minimum size of the frame. [3 marks]
 - (ii) draw a related diagram all of the above to support your answer. [3 marks]
 - (iii) what can the station do if there is a collision? [2 marks]

Continued...

Question 4

- (a) Draw a datagram format of Internet Protocol version 4 (IPv4).

[7 marks]

- (b) An IPv4 datagram has arrived with the following information in the header (in hexadecimal): 0x45 00 00 54 00 03 00 00 20 06 58 50 7C 4E 03 02 B4 0E 0F 02. Find the following:

- (i) Version

[1 mark]

- (ii) Header length

[1 mark]

- (iii) Service

[1 mark]

- (iv) Total Length

[1 mark]

- (v) Identification

[1 mark]

- (c) Figure 4(c) shows the flow of traversing a Multiprotocol Label Switching (MPLS) network. Each router has interfaces labeled 1, 2, 3. Draw and complete the forwarding tables for routers R1, R2 and R3 that define the label distribution to destination 30.1. (Ignore processing delay and queuing delays)

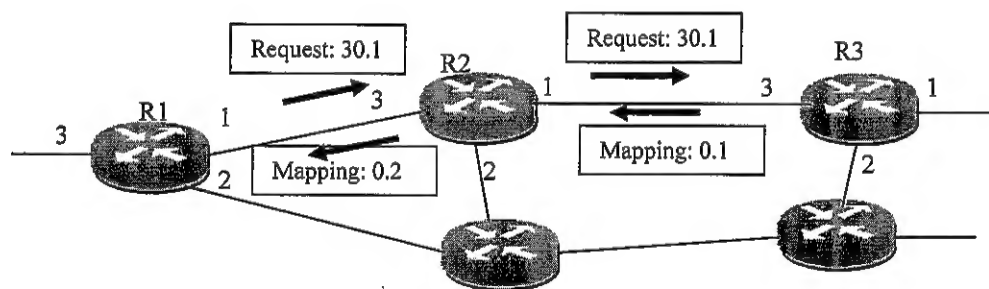


Figure 4(c)

[6 marks]

Continued...

- (d) Figure Q4(d) shows a weighted graph with six nodes (labelled v_1 to v_6). By using the Dijkstra's shortest path algorithm, generate the least-cost path tree from node 6 to all other nodes by completing the following table.

| | M | L1 Path | L2 Path | L3 Path | L4 Path | L5 Path |
|---|---|---------|---------|---------|---------|---------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |

[7 marks]

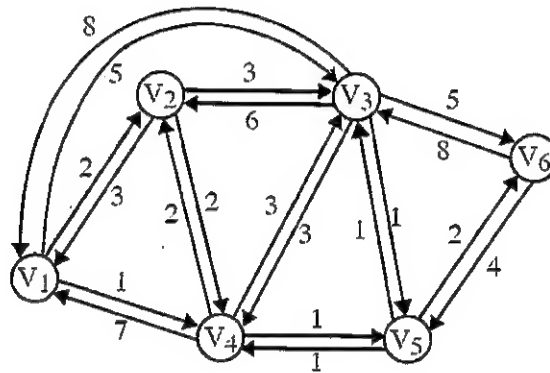


Figure 4(d)

End of Paper

Appendix

| Number of trunks | 1 lost call in | | | | Number of trunks | 1 lost call in | | | |
|------------------------|----------------|---------------|----------------|-----------------|------------------------|----------------|---------------|----------------|-----------------|
| | 50 (0.02) | 100 (0.01) | 200 (0.005) | 1000 (0.001) | | 50 (0.02) | 100 (0.01) | 200 (0.005) | 1000 (0.001) |
| | <i>E</i> | <i>E</i> | <i>E</i> | <i>E</i> | | <i>E</i> | <i>E</i> | <i>E</i> | <i>E</i> |
| 1 | 0.020 | 0.010 | 0.005 | 0.001 | 51 | 41.2 | 38.8 | 36.8 | 33.4 |
| 2 | 0.22 | 0.15 | 0.105 | 0.046 | 52 | 42.1 | 39.7 | 37.6 | 34.2 |
| 3 | 0.60 | 0.45 | 0.35 | 0.19 | 53 | 43.1 | 40.6 | 38.5 | 35.0 |
| 4 | 1.1 | 0.9 | 0.7 | 0.44 | 54 | 44.0 | 41.5 | 39.4 | 35.8 |
| 5 | 1.7 | 1.4 | 1.1 | 0.8 | 55 | 45.0 | 42.4 | 40.3 | 36.7 |
| 6 | 2.3 | 1.9 | 1.6 | 1.1 | 56 | 45.9 | 43.3 | 41.2 | 37.5 |
| 7 | 2.9 | 2.5 | 2.2 | 1.6 | 57 | 46.9 | 44.2 | 42.1 | 38.3 |
| 8 | 3.6 | 3.2 | 2.7 | 2.1 | 58 | 47.8 | 45.1 | 43.0 | 39.1 |
| 9 | 4.3 | 3.8 | 3.3 | 2.6 | 59 | 48.7 | 46.0 | 43.9 | 40.0 |
| 10 | 5.1 | 4.5 | 4.0 | 3.1 | 60 | 49.7 | 46.9 | 44.7 | 40.8 |
| 11 | 5.8 | 5.2 | 4.6 | 3.6 | 61 | 50.6 | 47.9 | 45.6 | 41.6 |
| 12 | 6.6 | 5.9 | 5.3 | 4.2 | 62 | 51.6 | 48.8 | 46.5 | 42.5 |
| 13 | 7.4 | 6.6 | 6.0 | 4.8 | 63 | 52.5 | 49.7 | 47.4 | 43.4 |
| 14 | 8.2 | 7.4 | 6.6 | 5.4 | 64 | 53.4 | 50.6 | 48.3 | 44.1 |
| 15 | 9.0 | 8.1 | 7.4 | 6.1 | 65 | 54.4 | 51.5 | 49.2 | 45.0 |
| 16 | 9.8 | 8.9 | 8.1 | 6.7 | 66 | 55.3 | 52.4 | 50.1 | 45.8 |
| 17 | 10.7 | 9.6 | 8.8 | 7.4 | 67 | 56.3 | 53.3 | 51.0 | 46.6 |
| 18 | 11.5 | 10.4 | 9.6 | 8.0 | 68 | 57.2 | 54.2 | 51.9 | 47.5 |
| 19 | 12.3 | 11.2 | 10.3 | 8.7 | 69 | 58.2 | 55.1 | 52.8 | 48.3 |
| 20 | 13.2 | 12.0 | 11.1 | 9.4 | 70 | 59.1 | 56.0 | 53.7 | 49.2 |
| 21 | 14.0 | 12.8 | 11.9 | 10.1 | 71 | 60.1 | 57.0 | 54.6 | 50.1 |
| 22 | 14.9 | 13.7 | 12.6 | 10.8 | 72 | 61.0 | 58.0 | 55.5 | 50.9 |
| 23 | 15.7 | 14.5 | 13.4 | 11.5 | 73 | 62.0 | 58.9 | 56.4 | 51.8 |
| 24 | 16.6 | 15.3 | 14.2 | 12.2 | 74 | 62.9 | 59.8 | 57.3 | 52.6 |
| 25 | 17.5 | 16.1 | 15.0 | 13.0 | 75 | 63.9 | 60.7 | 58.2 | 53.5 |
| 26 | 18.4 | 16.9 | 15.8 | 13.7 | 76 | 64.8 | 61.7 | 59.1 | 54.3 |
| 27 | 19.3 | 17.7 | 16.6 | 14.4 | 77 | 65.8 | 62.6 | 60.0 | 55.2 |
| 28 | 20.2 | 18.6 | 17.4 | 15.2 | 78 | 66.7 | 63.6 | 60.9 | 56.1 |
| 29 | 21.1 | 19.5 | 18.2 | 15.9 | 79 | 67.7 | 64.5 | 61.8 | 56.9 |
| 30 | 22.0 | 20.4 | 19.0 | 16.7 | 80 | 68.6 | 65.4 | 62.7 | 58.7 |
| 31 | 22.9 | 21.2 | 19.8 | 17.4 | 81 | 69.6 | 66.3 | 63.6 | 58.7 |
| 32 | 23.8 | 22.1 | 20.6 | 18.2 | 82 | 70.5 | 67.2 | 64.5 | 59.5 |
| 33 | 24.7 | 23.0 | 21.4 | 18.9 | 83 | 71.5 | 68.1 | 65.4 | 60.4 |
| 34 | 25.6 | 23.8 | 22.3 | 19.7 | 84 | 72.4 | 69.1 | 66.3 | 61.3 |
| 35 | 26.5 | 24.6 | 23.1 | 20.5 | 85 | 73.4 | 70.1 | 67.2 | 62.1 |
| 36 | 27.4 | 25.5 | 23.9 | 21.3 | 86 | 74.4 | 71.0 | 68.1 | 63.0 |
| 37 | 28.3 | 26.4 | 24.8 | 22.1 | 87 | 75.4 | 71.9 | 69.0 | 63.9 |
| 38 | 29.3 | 27.3 | 25.6 | 22.9 | 88 | 76.3 | 72.8 | 69.9 | 64.8 |
| 39 | 30.1 | 28.2 | 26.5 | 23.7 | 89 | 77.2 | 73.7 | 70.8 | 65.6 |
| 40 | 31.0 | 29.0 | 27.3 | 24.5 | 90 | 78.2 | 74.7 | 71.8 | 66.6 |
| 41 | 32.0 | 29.9 | 28.2 | 25.3 | 91 | 79.2 | 75.6 | 72.7 | 67.4 |
| 42 | 32.9 | 30.8 | 29.0 | 26.1 | 92 | 80.1 | 76.6 | 73.6 | 68.3 |
| 43 | 33.8 | 31.7 | 29.9 | 26.9 | 93 | 81.0 | 77.5 | 74.3 | 69.1 |
| 44 | 34.7 | 32.6 | 30.8 | 27.7 | 94 | 81.9 | 78.4 | 75.4 | 70.0 |
| 45 | 35.6 | 33.4 | 31.6 | 28.5 | 95 | 82.9 | 79.3 | 76.3 | 70.9 |
| 46 | 36.6 | 34.3 | 32.5 | 29.3 | 96 | 83.8 | 80.3 | 77.2 | 71.8 |
| 47 | 37.5 | 35.2 | 33.3 | 30.1 | 97 | 84.8 | 81.2 | 78.2 | 72.6 |
| 48 | 38.4 | 36.1 | 34.2 | 30.9 | 98 | 85.7 | 82.2 | 79.1 | 73.5 |
| 49 | 39.4 | 37.0 | 35.1 | 31.7 | 99 | 86.7 | 83.2 | 80.0 | 74.4 |
| 50 | 40.3 | 37.9 | 35.9 | 32.5 | 100 | 87.6 | 84.0 | 80.9 | 75.3 |